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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/809,463	07/18/1997	MITSUHIRO NAKAMURA	P97.0322	7619

7590 03/29/2004

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EXAMINER

CAO, PHAT X

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 03/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

08/809,463

Applicant(s)

NAKAMURA ET AL.

Examiner

Phat X. Cao

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 November 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 9-13, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson et al (US. 5,098,859) in view of Katz (US. 5,089,438).

Jackson discloses a device including a GaAs substrate, a non-single crystal semiconductor layer comprising In (see, for example, "EXAMPLE 3" as well as col. 5, line 56), and an uppermost conductive film made of WSi. With respect to claims 9 and 19, note figure 2.

Jackson fails to teach the claimed details of the uppermost conductive film.

However, Katz teaches a metal layer structure 13 including a TiN film containing oxygen (TiON) **or containing silicon (TiSiN)** (column 2, lines 1-7) for making contact with III-V semiconductor region 11 comprising In (column 2, lines 67-68 through column 3, lines 1-3). Katz teaches that such a contact structure allows for improving heat resistance to enhance reliability because of forming of a heat resisting metal TiSiN (column 1, lines 12-17). Accordingly, from the suggestion of Jackson that "the metal is not critical and any metal will make a good contact" (column 6, lines 7-10) and from the teaching of Katz that the heat resisting metal includes TiSiN for making contact with III-V semiconductor layer comprising In, it would have been obvious to one skilled in the art at the time the invention was made to substitute the heat resisting metal of TiSiN as taught by Katz because according to Katz, TiSiN can be used to contact III-V

semiconductor layer comprising In for improving conductivity and heat resistance to enhance reliability (column 1, lines 12-17).

3. Claims 4-8 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson and Katz as applied to claim (1,10) above, and further in view of Nirschl et al (DE 41 29 647 A1).

With respect to claims 4-6 and 14-16, the combination of Jackson and Katz substantially reads on the above claims, except that it fails to disclose the uppermost conductive film comprising a metallization series as claimed.

However, Nirschl teaches a metal structure for making contact with III-V semiconductor regions. Nirschl's structure includes a metallization series comprising: a first metal layer (2), a nitride layer (5), a refractory metal film (6) of titanium (see page 7, lines 18-19 of English translation) and a second metal layer (4). Accordingly, it would have been obvious to one skilled in the art at the time the invention was made to form the device as disclosed by Jackson with a conductive film structure as taught by Nirschl because according to Nirschl, such metallization series are necessary to create connectors for electrical contact on the surface of III-V semiconductors (page 2, lines 3-6 of English translation), especially for optoelectronics semiconductor chips (page 11, lines 1 of English translation), in order to allow for reliable high temperature operation (page 8, lines 8-12 of English translation).

With respect to claims 8 and 18, Nirschl teaches the use of titanium refractory metal other than the use of refractory metals of W, Ta, and Mo as claimed. However, because W, Ta, Mo and Ti are well known refractory metals and commonly used in the

art for the well known purpose of reducing the contact resistances, it would have been obvious to select W, Ta, or Mo for Nirschl's Ti because of their equivalence for their use in the semiconductor art as conductive materials and the selection of any of these known equivalents to be used as a low resistivity conductive material would be within the level of skill in the art.

With respect to claims 7 and 17, while Nirschl uses a metal other than those claimed by Applicant, the claimed metals are well known in the art and their use in Nirschl's structure would have been obvious to a skilled artisan at the time of invention as a result of routine engineering design, optimization, and implementation considerations.

Response to Arguments

4. Applicant argues that Katz does not suggest the metal nitride film of TiSiN as claimed.

This argument is not persuasive because Katz clearly states in column 2, lines 17:

"By 'TiN' herein we do not only mean material that contains, **in addition to TiN**, unavoidably or inadvertently present impurities (e.g., carbon and/or material that contains oxygen, **but also that contains an intentionally introduced dopant** (e.g., Zn or Si)."

Therefore, Katz does suggest the metal nitride film of TiSiN as claimed.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is (571) 272-1703. The examiner can normally be reached on Monday - Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PC
March 19, 2004



PHAT X. CAO
PRIMARY EXAMINER